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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,581	07/19/2006	Tsuguo Fukuda	062697	6163
38834 7590 08/17/2007 WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP 1250 CONNECTICUT AVENUE, NW SUITE 700 WASHINGTON, DC 20036			EXAMINER CHAET, MARISSA W	
			ART UNIT 1722	PAPER NUMBER
			MAIL DATE 08/17/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/586,581

Applicant(s)

FUKUDA ET AL.

Examiner

Marissa W. Chaet

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 24 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 7/19/06.

- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 1-3, 5-6, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata et al. (US 6,270,569) in view of Usui et al. (US 2002/0197825).**

Regarding claims 1-2, Shibata discloses a process for producing single crystals of GaN on a seed crystal substrate by a reaction between molten gallium retained in a container inside a crystal growth chamber and nitrogen gas, the process comprising: preparing an alloy melt of gallium; dipping the seed crystal substrate into the melt, the substrate including a crystal layer comprising of gallium; and epitaxially growing a single crystal film of the GaN on the surface of the substrate by the reaction at the surface of the substrate between gallium and nitrogen dissolving into the melt from a zone containing a nitrogen supply source above a surface of the melt. See col. 9, lines 20-37; col. 17, line 60 – col. 18, line 50.

Regarding claim 3, Shibata discloses forming the alloy melt with gallium and bismuth. See col. 18, lines 42-51.

Regarding claim 5, Shibata discloses ammonia as the nitrogen-containing compound gas. See abstract.

Regarding claim 6, Shibata discloses a sapphire substrate. See col. 9, line 60-65.

Regarding claim 9, Shibata discloses a substrate (16) attached to a lower end portion of a drive shaft (18). See Fig. 2; col. 9, lines 60-67.

Shibata does not disclose a catalytic metal in the process. However, Usui discloses adding a catalyst, such as platinum and iridium, to the substrate. See para. 81-88. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Shibata to provide a catalyst, such as in Usui, to accelerate the decomposition of a first semiconductor layer of a group III nitride. Furthermore, a catalytic metal having a mesh, stripes, or an open polka-dot pattern does not further limit the claim.

**Claims 4, 8, and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata et al. (US 6,270,569) in view of Usui et al. (US 2002/0197825) and in further view of Kitaoka et al (US 2004/0144300).**

Regarding claim 4, the combination of Shibata and Usui does not disclose a pressure between 0.1 and 0.15 MPa in the space containing the nitrogen supply. However, Kitaoka discloses a nitrogen gas atmosphere of between 1 to 50 atm, or 0.10 to 5.07 MPa. See para. 48. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combination of Shibata and Usui to provide a nitrogen gas atmosphere between 0.1 and 5 MPa, such as suggested in Kitaoka, to create an optimal environment for the reaction between the nitrogen gas and the molten Ga alloy.

Regarding claim 8, the combination of Shibata and Usui does not disclose a single crystal film represented by Al, Ga, In, and N. However, Kitaoka discloses a film having a composition formula of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  (wherein  $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ , and  $0 \leq 1-x-y \leq 1$ ). See para. 50. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combination of Shibata and Usui to produce a film composing Al, Ga, In, and N, such as suggested in Kitaoka, to provide a substrate that has less variations in in-plane carrier concentration.

Regarding claim 10, the combination of Shibata and Usui does not disclose different temperature zones. However, Kitaoka discloses a crystal growth chamber with two temperature zones in the vertical direction. See Fig. 8, #83, 84; para. 89. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combination of Shibata and Usui to provide two different temperature zones, such as suggested in Kitaoka, to produce the different temperatures needed for melt preparation the crystal formation.

Regarding claim 11, the combination of Shibata and Usui does not disclose an increase of between 100 and 150°C between the temperature at which a metal forms an alloy with gallium and the temperature at which to prepare the alloy melt. However, Kitaoka discloses a temperature of 900°C to melt the raw materials and a lowered temperature of 800°C to bring the melt to a supersaturation state. See para. 66-67. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combination of Shibata and Usui to provide a lowered

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temperature of 100°C, such as suggested in Kitaoka, to prepare the melt for the growth of GaN crystals.

Regarding claim 12, the combination of Shibata and Usui does not disclose a crystal film thickness of between 100 and 200 micrometers. However, Kitaoka discloses a crystal film thickness of about 100 micrometers. See para. 32. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combination of Shibata and Usui to provide a film thickness of 100 micrometers, such as suggested in Kitaoka, to obtain crystals having high flatness and without facets.

### ***Conclusion***


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marissa W. Chaet whose telephone number is 571-272-8094. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra N. Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MWC  
August 9, 2007

  
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SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1722